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(54) **Electric toothbrush**

(57) A electrically driven toothbrush has the brush (23) selectively movable in two modes, performing a circular motion or a side-to-side reciprocal motion. The output of a motor (12) is taken through a reduction device (15) to a crank (18) via a bevel gear (17), a crank pin (19) on the crank seating in a guide groove (22) formed in the base portion of a brush holder (21), and a guide pin (20) also seating in the guide groove (22). A switching member (24) determines the mode of operation by being movable from engagement with the guide pin (20) to engagement with the crank pin (19). In each mode the guide pin (20) acts as a fulcrum for the brush holder (21).

FIG. 8

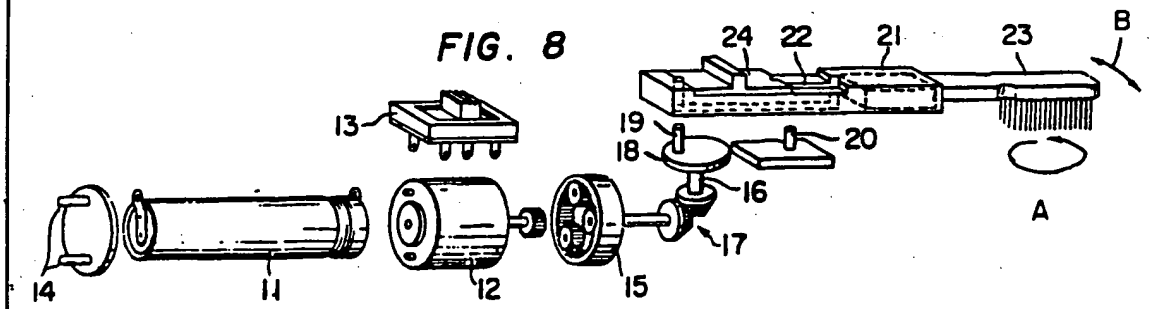

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FIG. 1

FIG. 2

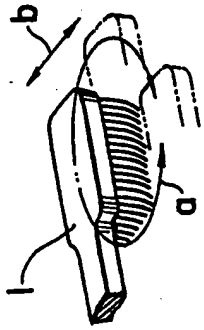


FIG. 3

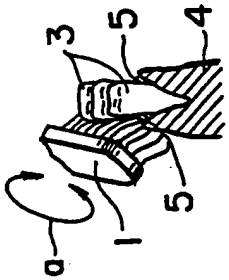


FIG. 4

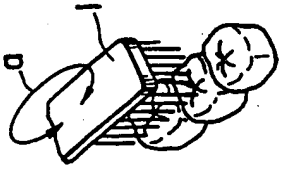
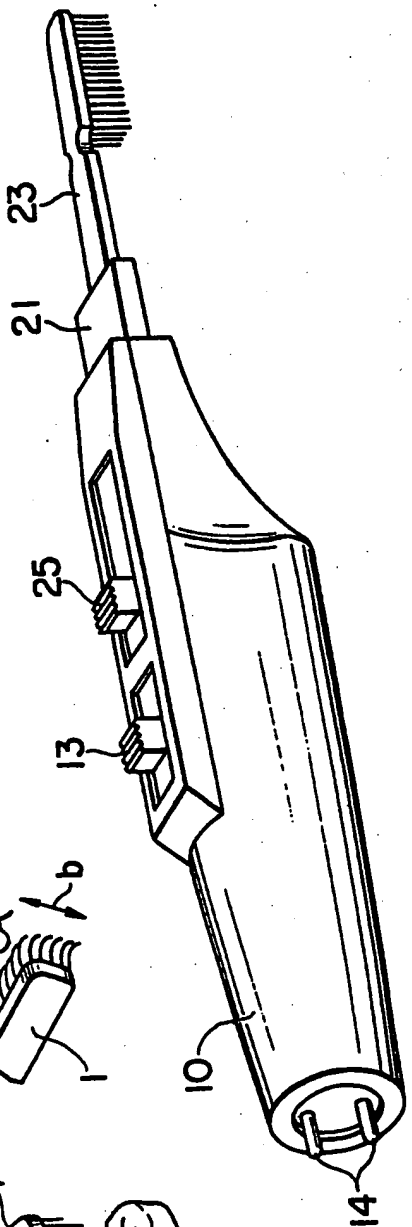


FIG. 5

FIG. 6



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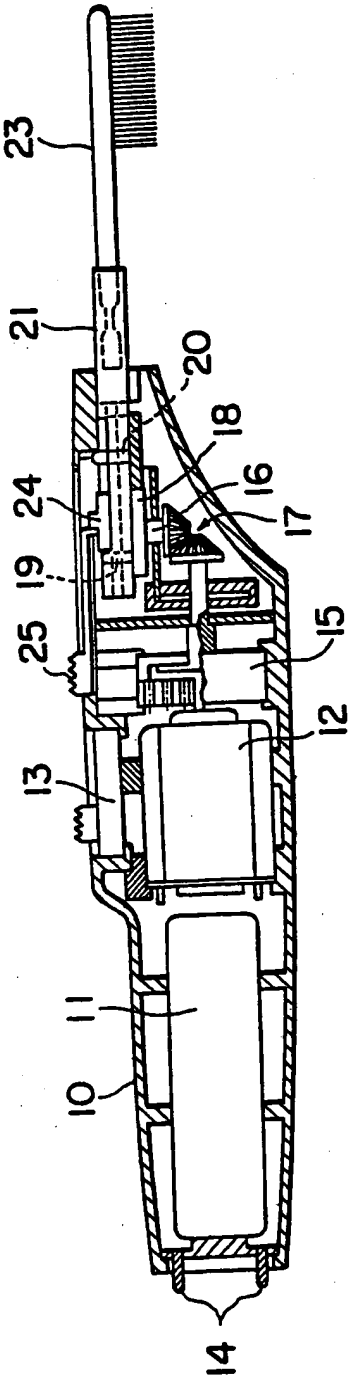

FIG. 7

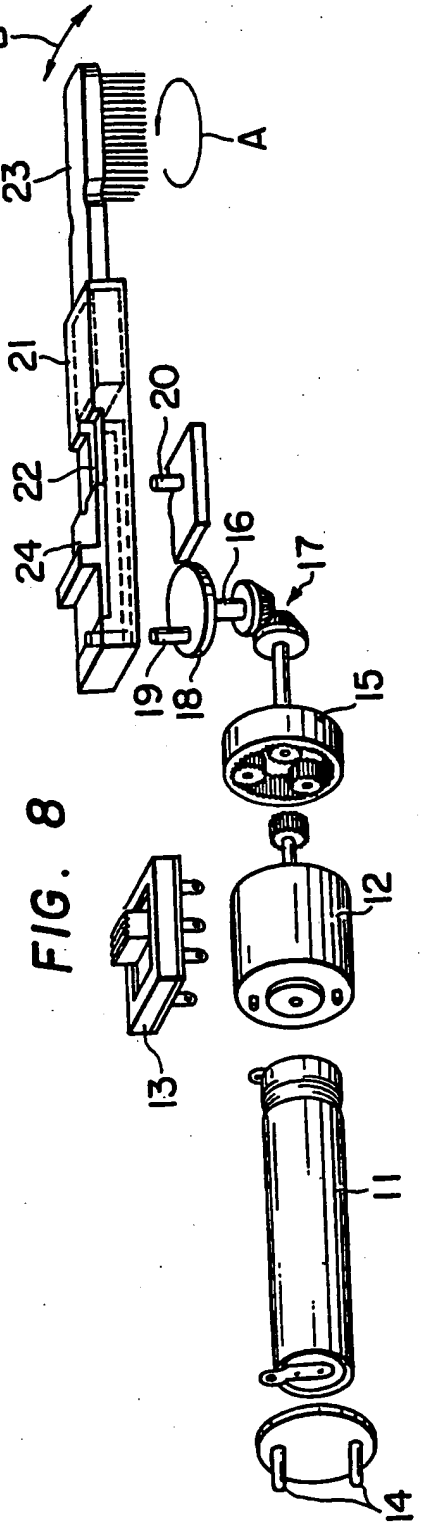

FIG. 8

SPECIFICATION

Electric toothbrush

The present invention relates to an electrically driven toothbrush which is designed so that the brush moves in ideal directions.

The conventional toothbrush motion is shown in Fig. 1 where the brush 1 is moved reciprocally with respect to the row of teeth 2, irrespective of whether the toothbrush is manually operated or electrically operated, and therefore the recess portions of the teeth 2 are not sufficiently brushed. The brushing tends to be effected only on the surface portions of the teeth where relatively little dental dirt accumulates. Therefore, the conventional brushes are not adequate to ensure proper cleaning of the teeth.

Through keen research it has now been found that the dental dirt is most effectively removed if the brush 1 is rotated in a circular motion as represented by arrow *a* in Fig. 2, and if for some parts of the row of teeth the brush is moved reciprocally from side-to-side as indicated by arrow *b*.

In other words, to remove the dental dirt 5 accumulated in the crevice between a tooth 3 and the gum as shown in Fig. 3, the brush 1 should be rotated in the direction of arrow *a*, so that the bristles of the brush 1 perform an inverted conical motion with the roots of the bristles describing circular paths about the tips of the bristles which serve as apices and which are in contact with the gum groove, thereby enabling the dirt 5 to be removed almost completely. Furthermore, the teeth can also be cleaned if the brush is turned with respect to the occluding surfaces while the brush is rotated (Fig. 4), the bristle tips serving as non-moving points performing the aforesaid inverted conical motion following the rotary motion of the brush. In this case, the bristle tips serving as non-moving points scrape off the dirt from the surface of the teeth, and spring the waste material out when the direction of motion is changed, making it possible to clean the rugged occluding surfaces as well as the gum crevices.

Moreover, it has long been known that tooth dirt and residual food accumulated at the base of the teeth can effectively be removed if the brush 1 is moved reciprocally in the direction of arrow *b* as shown in Fig. 5.

It is therefore an object of the present invention to provide an electrically driven brush where the brush can operate in two modes, i.e. to move in a flat circular path as well as to move reciprocally from side-to-side to attain an effective cleaning of the teeth.

In accordance with the invention there is provided an electrically driven toothbrush comprising a brush holder which is detachably fitted with a brush at the front end thereof, the brush and holder being able to move relative to a casing which is provided with power supply means and motor drive means; a crank pin provided on a crank and driven for rotation from the motor drive means; a guide pin fixed relative to the casing and parallel with the crank pin; a guide groove in the brush holder in which both the crank pin and the guide pin are slidable; and a switching member slidable relative to the guide groove between latching engagement with the crank pin and latching engagement with the guide pin, said alternative latching engagements enabling the brush to be driven in two modes, in one of which the brush undergoes a rotary motion and in the other of which the brush undergoes a side-to-side reciprocating motion, with the tips of the brush bristles moving in the same plane in both modes.

With this electrically driven toothbrush the bristle tips of the brush inserted in the gum grooves perform a motion described as a reversed or inverted conical motion with the bristle tips as apices while the brush performs the rotary movement, or else the brush performs a motion like that of a windscreen wiper of an automobile so that the dental dirt in the gum grooves is sprung out by the tips of the bristles.

Preferably, the brush is switched between the two modes by manipulation of a switching member so that both the occluding surfaces on the rugged molar portions and also the gum grooves which are difficult to brush can be cleaned easily without requiring any particular skill.

In the drawings:

Figure 1 is a view showing the motion of a conventional brush;

Figure 2 is a perspective view showing the motion of a brush according to the present invention;

Figure 3 is a cross-sectional view showing an example of brushing movement according to the present invention.

Figure 4 is a perspective view showing another example of brushing movement according to the present invention;

Figure 5 is a perspective view showing a further example of brushing movement according to the present invention;

Figure 6 is a perspective view showing an embodiment of electrically driven toothbrush according to the present invention;

Figure 7 is a sectional side view showing the internal mechanism of the electrically driven toothbrush;

Figure 8 is an exploded view of the important parts of the electrically driven toothbrush of Figure 7.

The present invention is now described in detail with reference to the embodiment shown by way of example in Figures 6 to 8.

In the drawings, reference numeral 10 represents a casing containing a rechargeable power-supply battery 11 and a motor 12. The

battery 11 and the motor 12 are connected together via a power supply switch 13 which is exposed on the outside of the casing 10. The power supply switch 13 functions to turn the motor 12 on or off, as well as to change the direction of rotation of the motor 12 between the forward direction and the reverse direction. A plug 14 is connected to the battery 11 to enable the battery to be recharged. The plug 14 can protrude retractably beyond the rear surface of the casing 10. A planetary gear-type reduction device 15 is connected to the output shaft of the motor 12 and the output shaft of the planetary gear-type reduction device 15 is connected via a bevel gear 17 to a rotary shaft 16 supported by the casing 10. To the rotary shaft 16 is fastened a crank 18 on which is studded a crank pin 19 which is parallel to the rotary shaft 16. A guide pin 20 which is parallel to the crank pin 19 is fixed to the casing 10 or is integral therewith. The crank pin 19 and the guide pin 20 are slidably inserted in a guide groove 22 in which a brush 23 is detachably inserted, the guide groove 22 being formed in a brush holder 21 along the length thereof. The brush holder 21 is located on a flat portion of the casing 10. A switching member 24 is provided on the upper surface of the brush holder 21 to cover part of the upper surface of the guide groove 22. The rear surface of the switching member 24 faces towards the crank pin 19 and the front surface of the switching member 24 faces towards the guide pin 20, these surfaces being notched to receive the pins. The switching member 24 slides on the brush holder 21 along the guide groove 22. Furthermore, between the brush holder 21 and the switching member 24 is interposed a stop member which is not shown, so that the switching member 24 is stopped at the front end and at the rear end of the guide groove 22. An operating latch 25 engageable with the switching member 24 is slidably mounted in the groove 22 in such a manner that its head portion is exposed above the groove in the casing 10, whereby the switching member 24 can be slid back and forth by movement of the latch, thereby overcoming the force of the stop member.

With the thus constructed electrically driven toothbrush, when the motor 12 rotates, the output rotational speed is reduced by the planetary gear-type reduction device 15, and the crank pin 19 is then turned via the bevel gears 17 with the rotary shaft 16 as a centre. In this situation, if the switching member 24 is engaged with the brush holder 21 with the switching member at the rear end of the groove as shown in Fig. 8, the crank pin 19 is held fast between the rear end of the switching member 24 and the rear end of the guide groove 22. The rear end of the brush holder 21 is thus caused to undergo a circular motion, following the rotary motion of the crank pin 19. Since sufficient distance is maintained between the guide pin 20 studded on the casing 10 and the front end of the switching member 24, the brush holder 21 is caused to extend and retract while swinging to the right and left with the guide pin 20 acting as a fulcrum. That is, if the switching member 24 is moved back so as to reduce the effective length of the guide groove 22 with respect to the crank pin 19, the brush holder 2 performs a rotary motion following the rotary motion of the crank pin 19 and thereby causing the brush 23 attached to the front portion of the brush holder 21 to move in the direction of arrow A in a circular path about an axis perpendicular to the longitudinal axis of the brush and holder and parallel to the axes of the bristles.

If the switching member 24 is then moved forward to clamp the guide pin 20 and to reduce the effective length of the guide groove 22 with respect to the guide pin 20, the effective length of the guide groove 22 with respect to the crank pin 19 is increased whereby the crank pin 19 is allowed to slide back and forth in the guide groove 22, and the guide pin 20 serves as a fulcrum for the brush holder 21. When now the crank pin 19 is turned by the rotational force of the motor 12, the crank pin 19 slides back and forth in the guide groove 22, and the rear end of the brush holder 21 swings in an arc to the right and left about the guide pin fulcrum. As a result, the brush holder 21 oscillates to the right and left with the guide pin 20 acting as a fulcrum causing the brush 23 to perform an arcuate reciprocating motion in the direction of arrow B, i.e. a reciprocating side-to-side motion, like that of an automobile windscreen wiper.

The direction of rotation of the brush 23 in the first mode can of course be reversed simply by reversing the power supply switch 13.

In the described embodiment, a rechargeable battery is employed as a power-supply battery for economical reasons, a planetary gear-type reduction device is used as a reduction mechanism to reduce the size of the reduction device, the same guide groove is used both for the crank pin and for the guide pin to simplify the shape of the brush holder, and the effective length of the guide groove is changed to effect the change-over from the rotary motion to the reciprocating motion in order to simplify the change-over member and its mechanism. It should be noted however that the present invention is not limited to the particular arrangement described above.

It is preferred that the toothbrush is rotated at a speed of 170 to 230 revolutions per minute, so that the speed of rotation is approximately equal to that achieved when the brush is moved just by hand.

CLAIMS

1. An electrically driven toothbrush comprising a brush holder which is detachably fitted with a brush at the front end thereof, the brush and holder being able to move relative to a casing which is provided with power supply means and motor drive means; a crank pin provided on a crank and driven for rotation from the motor drive means; a guide pin fixed relative to the casing and parallel with the crank pin; a guide groove in the brush holder in which both the crank pin and the guide pin are slidable; and a switching member slidable relative to the guide groove between latching engagement with the crank pin and latching engagement with the guide pin, said alternative latching engagements enabling the brush to be driven in two modes, in one of which the brush undergoes a rotary motion and in the other of which the brush undergoes a side-to-side reciprocating motion, with the tips of the brush bristles moving in the same plane in both modes.

2. An electrically driven toothbrush according to claim 1, wherein said motor drive means can drive the crank pin in both clockwise and anticlockwise directions.

3. An electrically driven toothbrush according to claim 1 or 2, wherein said power supply means comprises a rechargeable battery.

4. An electrically driven toothbrush according to claim 1, 2 or 3 wherein said motor drive means includes a planetary gear-type reduction device.

5. An electrically driven toothbrush according to any preceding claim, wherein a rotary shaft of the crank is driven by the motor drive means via a reduction mechanism and bevel gears.

6. An electrically driven toothbrush according to any preceding claim, wherein said guide groove is formed in the longitudinal direction of the brush holder and the crank pin and the guide pin are held fast by the switching member at respective opposite ends of the groove.

7. An electrically driven toothbrush according to any preceding claim, wherein a manual catch is provided engageable with the switching member and having a head portion projecting from the casing.

8. An electrically driven toothbrush substantially as hereinbefore described with reference to the accompanying drawings.

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